

Birth Weight and Place: The Impact of Structural Level Characteristics on Infant Health Outcomes

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Birth Weight and Variation Across Place

- Regional variation in low birth weight
- Varies from 3.8 to 10.6 per 100 live births across regions in the U.S. (Thompson et al. 2005)
- Improvements in child and infant health, still little known about early childhood conditions and morbidity patterns
- Low birth weight may help in understanding underlying causes of disease for infants and children

Why Study Birth Weight?

- Inequality leads to differential health outcomes for adults, likely to be observed for infants
- Link between structural level characteristics and individual infant health outcomes needs more theoretical development
- Ecologic Inequality – the characteristics of the places people live, both physical and social, make an independent contribution to health outcomes rather than just acting as a proxy for individual level data (Soobader and LeClere 1999)

Research Questions

- How do structural level characteristics influence individual birth weights, and do these structural level measures have independent effects on birth weight at the individual level?
- Further if these relationships exist, are there cross-level effects indicating that certain structural level measures operate differently for individual infants, such as racial/ethnic groups or based on income?

Hypotheses

1. Structural level characteristics (minority concentration, county infant mortality rates, percent of female headed households, and health care service concentration) are hypothesized to have an independent effect on average birth weights for individual infants in the population. However without the inclusion of individual level characteristic of infants and their families, the effects of structural level measures are likely to be overestimated.

Hypotheses

2. Black infants residing in counties with high county level concentrations of black residents will have higher birth weights.
3. Low income individuals living in counties with higher percentages of female headed households at the county level will have higher birth weights.
4. White infants residing in counties with high concentrations of minorities in the county will experience lower birth weights.
5. Infants born in counties with a high infant mortality rate will have lower birth weights

How Do We Study Birth Weight: Data and Methods

- Early Childhood Longitudinal Study – Birth Cohort (ECLS-B)
- Approximately 10,600 infants sampled at 9 months from all births in 2001 located in 176 counties
- Birth Certificate Data
- 2000 U.S. Census of Population and Housing Summary File 3; 2004 Area Resource Files
- Multiple Regression with Jackknife Two Estimation
- Multilevel Modeling with Weighting

Birth Weight and Individual-Level Factors

- Biological
- Social
- Behavioral

Results of Individual-Level Models

- Endogenous factors, such as biological characteristics of the mother and infant, are the main determinant of birth weight.
- Results from this analysis indicate that almost a third of the variation in birth weight is attributable to the biological, social, and behavioral characteristics included in these models.
- The largest predictor of birth weight in all of these models is gestational age, which is not surprising.

Results of Individual-Level Models

- The measure of income equivalence is positive and statistically significant; indicating that additional income based on family consumption needs helps to increase birth weight.
- Mothers completing a college degree have infants that weigh more than mothers without a complete high school education.
- Having access to private insurance increases birth weight.

Results of Individual-Level Models

- Black and Asian infants weigh less at birth than white infants, 116.90 grams less for blacks and 196.27 grams less for Asians.
- No statistically significant differences in birth weight are found between whites and Hispanics, whites and American Indians, or whites and infants of other or multiple races, when controls for income, mother's education, insurance status, and all biological characteristics are included.

Results of Individual-Level Models

- Smoking has a strong, negative effect on birth weight.
- Mothers that smoke during their pregnancy have infants that weigh less at birth than infants born to mothers that do not smoke.
- Obtaining adequate prenatal care is important for having an infant of normal birth weight.
- Gaining sixteen or more pounds during pregnancy is also advantageous to birth weight.

Results of Individual-Level Models

- With the inclusion of behavioral characteristics in the model, some of the relationships with social characteristics and birth weight change in their significance.
- Household income is no longer statistically significant in determining birth weight. However the total number of household members becomes statistically significant, indicating additional members in the household increase birth weights.
- Also interesting to note is the marginally significant difference observed for birth weights between Hispanics and whites. This could be due to difference in smoking behaviors, prenatal care usage, and weight gain during pregnancy between Hispanic and whites.
- Relationships between biological characteristics and birth weight remain the same when all variables are included in the final model.

Variation In Birth Weight Based on the Infant's County of Residence

- To examine the total amount of variation in individual birth weights, a fully unconditional, or null, model was examined. Results from this model separate the total variance into within- and between-county components.
- The results indicate that there is overwhelmingly more within-county (individual) than between-county (mean across counties) variation.
- Less than one percent of total variation in individual birth weights is attributed to between-county differences (0.002), while within-county individual differences account for almost all of the variation (0.998).
- The large amount of variation between individuals is expected since individual health outcomes range widely between people.

Results of Multi-Level Models

- When all individual-level measures are controlled, a multi-level model including the five year infant mortality rate for the county indicates that infants born in counties with a high infant mortality rate weigh more at birth than infants born in counties with low infant mortality rates.
- This could be seen as a protective biological mechanism in which infants must be born with higher birth weights in order to survive in areas with poor infant mortality outcomes. However this relationship is only marginally significant and with the inclusion of other county level characteristics becomes statistically non-significant.

Results of Multi-Level Models

- When a measure of the percentage of the county population that is black is included along with individual-level controls, no significant relationship is observed between this measure and individual birth weight.
- A cross-level interaction term was also tested between the percentage of the county population that is black and the individual level measure of whether the child was black. However the relationship between the county level measure and the outcome did not change and no significant relationship was observed for the interaction term.

Results of Multi-Level Models

- The percentage of the county population that is black is positive and significant with the inclusion of the percentage of the county population that is Hispanic. This coefficient indicates that individual birth weights are higher in counties with a large black population. However this relationship is no longer significant with the inclusion of economic and health service resources included in subsequent models.

Results of Multi-Level Models

- Even though there are significant relationships found with the inclusion of other county-level characteristics in these models, it should be noted that the almost non-existent variation in individual birth weight between counties does not offer much substantive support for relationships between these county level variables and the outcome, individual birth weight, even though they appear to be statistically significant.

Discussion

- Overall results from this research indicate that little, if any, variation exists in individual birth weight between counties in the United States, and that while certain county-level measures appear statistically significant in multilevel analyses their substantive importance must be offered cautiously.
- No support was found for the hypotheses presented in this research.

Discussion

- Still the idea that racial concentration in places is likely to influence individuals of various races/ethnicities differently is sound and should be examined for other infant health outcomes, such as infant mortality, childhood obesity, or particular morbidities experienced in childhood. The establishment of these relationships could offer new insights into racial disparities in health outcomes.

Future Directions

- Another issue that should be considered for future research is the level at which structural level measures should be incorporated into multilevel models.
- While counties serve an administrative capacity and data are easily available, they are not the unit at which most people interact on a daily basis.
- Better measures at the local level, such as blocks or neighborhoods, might offer more insight into the impact of structural level characteristics on birth weight and other infant and child health outcomes since this is the area in which people interact and make daily decisions.

Future Directions

- Additionally, the subsequent waves of the ECLS-B offer the opportunity to apply a framework, like the one detailed above, to infant and child health outcomes that are dependent on the social and environmental characteristics of places.
- Future work should adopt a more rigorous and multidimensional approach to the study of infant and child health if we are to eliminate disparities early in life.